SNOW-GARLANDS

By W. J. HUMPHREYS

Once in a "blue moon" trees and other objects are decorated with snow-garlands—ropes of damp, or refrozen, snow several feet long, fast at both ends and hanging in catenary loops in between. Snow draperies, that is, pendant sheets and clinging masses of snow, or snow and ice, fast at one end and free at the other, are far more common; they often hang over the eaves of a house when a gentle thaw, especially one supplemented by heating beneath, causes the snow, or snow and under layer of ice, slowly to slide down the roof. A fine example of snow drapery is shown on page 191, volume 118, 1918 of the *Scientific American*.

Snow-garlands, however, as stated are far rarer and more spectacular than snow draperies. Only four brief accounts of them have come to my attention, and they only with the aid of the Weather Bureau's resourceful factician, Mr. C. F. Talman.

The earliest of these is by Hellmann [1] who reports their occurrence the last week of February 1889, on the limbs of trees in the Thiergarten of Berlin, and christens them "snow-garlands." The second is by Assmann [2], and refers to the same occurrence—the one noted by Hellmann. The third, by Kassner [3], describes, with illustrations, snow-garlands that on February 1, 1907, hung from ledges on the wall of a large brick building in Berlin. The fourth, and latest, with illustrations taken at the Central Meteorological Observatory of Japan on January 31, 1925 by S. Ohti, appeared in a Japanese publication; exact reference not known. One of the pictures (there are three) is reproduced in "The Realm of the Air" by C. F. Talman, 1931.

Anyhow, the accounts of this phenomenon appear to be few and far between, so few indeed that the accompanying reproduction of a photograph of an exceptionally fine example of a snow-garland must be of general interest. This picture was taken by Mr. E. P. Gibson (exact date not given), assistant city engineer, East Grand Rapids, Mich., who has kindly authorized its reproduction. He says: "The 'snow rope' was in suspension from two points on the railing slightly over 3 feet apart * * * the festoon was 7 to 8 inches thick in the center, thinning at the points of suspension, and the width at center of span I should estimate at 6 to 7 inches. It formed upon a 4-inch board which was the top of the railing." He also says that during the day or two the garland was sagging and lengthening the temperature held to near the melting point, with alternate brief intervals of thawing and freezing.

Such are the facts of observation. But what is the explanation of this holding of snow crystal to snow crystal in a continuous suspension bridge from anchorage to anchorage? Nothing, we are told, is more impossible than making a rope of sand; and yet of ice sand, that is, of snow crystals, Nature makes suspension bridges, or garlands, if we prefer art to engineering. How does she do it?

The fact that these garlands do not occur when the snow is dry, but only when it is wet, from partial thawing, rules out the suggestion that the snow crystals, or flakes, cling to each other by irregularities on their sides and faces, like so many prickly-burrs. But while one suggested explanation is thus removed another is so strongly supported by the same facts as to compel its acceptance. This is, that the snow crystals, being wet, are strongly drawn each to its adjacent neighbors, by the surface tension of a water film, and thus through film and flake the whole snow-garland tenaciously held together from end to end.

The following experiments are convincing of this: Take a lot of unglazed bits of paper, 1 to 2 millimeters across, and roll them together to the size and shape of a cigarette and try to suspend the collection from its two ends without other support. Immediately it falls apart like the fabled rope of sand. Roll them together again and then put enough water on them to make them wet through and through but not drippy. Now they are held together by the surface tension of water films and will hang nicely in a festoon supported at the two ends only. And as it is with the bits of paper so it is also with snow crystals. They fall apart when dry and cling together when wet.

Obviously a wet, sagging, snow-garland may be subjected to below-freezing temperatures, in which case it then will maintain its shape and position by virtue of the tensile strength of continuous ice, however porous it may be, and not through surface tension as before. In any case the garland is first formed of damp snow whose flakes and particles are held together then, and often for many hours thereafter, by the surface tension of water films.

[1] Met. Zeit, 6, 120, 1889. [2] Das Wetter, 6, 132, 1889. [3] Das Wetter, 24, 141, 1907.

ANALYSES OF RAINS AND SNOWS AT MOUNT VERNON, IOWA, 1934–35

By WILLARD A. KREHL and NICHOLAS KNIGHT

[Cornell College, Mount Vernon, Iowa, June 1935]

During the past several months we have continued the analyses of rains and snows at Mount Vernon, Iowa, which have been made in the Cornell College chemical laboratories for about 25 years. Efforts have been made to secure accurate and trustworthy results.

Specimen 7, November 20, 1934, was precipitated during heavy thunder and lightning. Specimen 11, November 28, came after the wind had been in the east for a number of days, and we found a rather unusual quantity of NaCl.

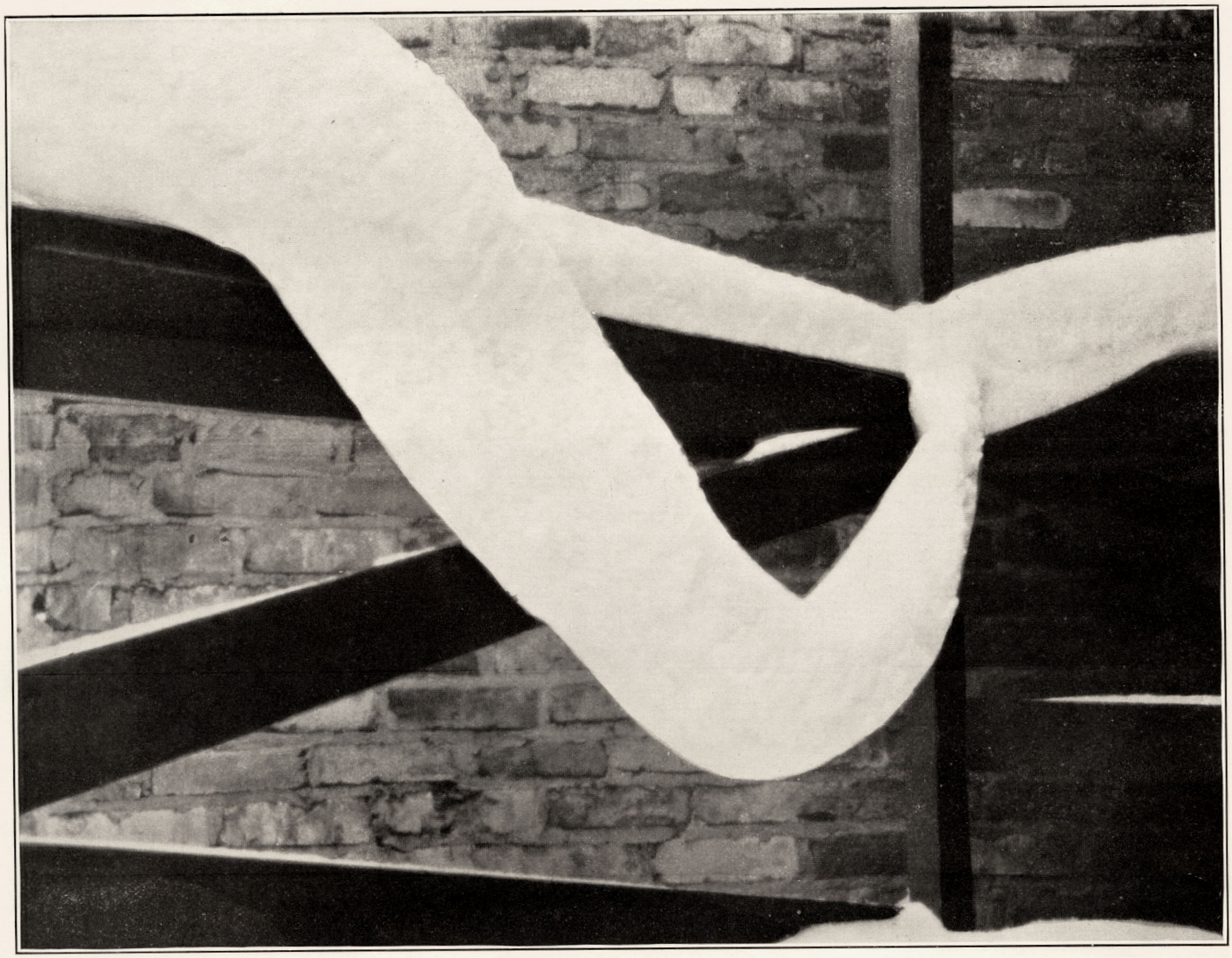
During a considerable period, precipitation occurred at frequent intervals, and our results show how frequent storms purify the air.

In specimen 17, the sulphate was unusually high, as the snow fell during a period of extreme cold and the people were burning considerable coal for fuel. We believe that burning coal, and in some cases dust storms, are the main sources of sulphate in the air.

The newspapers contained numerous reports of a severe dust storm on March 16, about the time specimen 30 was precipitated. The analysis indicates that the dust did not reach this locality. The analyses usually show the effect of dust storms. The first thunder and lightning of the season occurred during the precipitation of specimen 31 on March 24.

Much dust collected in the pans at the time of the storm on May 1, 1935. Heavy thunder and lightning accompanied a portion of this storm.

Altogether, we analyzed 40 specimens—28 of rain, and 12 of snow.



Snow-garland (E. P. Gibson).

TABLE 1.—*Parts per million*

Specimen	Date, 1934–35	Depth of rain or snow	Chlorine	Free ammonia	Alf. ammonia	N in nitrate	N in nitrite	Sulphate, SO_3
		Inches						
1	June 23	[1] 0.2	2.13	0.04	0.32	0.8	0.00	0.00
2	June 25	.4	2.84	.04	.11	.6	.00	.00
3	Sept. 28	[1] .12	3.55	.72	.28	.4	.01	.00
4	Oct. 20	1.2	3.55	.36	.24	.7	.02	.016
5	Nov. 3	1.75	3.55	.16	.20	.1	.02	.00
6	Nov. 18	1.15	1.42	.08	.03	.13	.00	.013
7	Nov. 20	1.00	2.13	.16	.112	.10	.02	.009
8	Nov. 22	.95	1.42	.08	.20	.084	.031	.009
9	Nov. 22	[1] .08	4.97	.272	.48	.47	.033	.009
10	Nov. 26	[1] .20	2.13	.04	.72	.10	.019	.011
11	Nov. 28	[1] 1.00	7.10	.02	.16	.10	.014	.007
12	Nov. 30	[1] 1.00 [2] .5	2.13	.04	.20	.00	.003	.0009
13	Dec. 3	[1] 4.00	1.42	.00	.20	.05	.006	.0005
14	Dec. 6	[2] 4.00	1.42	.08	.56	.03	.012	.0085
15	Dec. 19	[2] 2.00	2.84	.24	.40	.0105	.01	.005
16	Dec. 26	[2] 2.00	.00	.56	.80	.117	.029	.022
17	Jan. 9	[1] .4	3.6	.112	.72	.05	.012	.0103
18	Jan. 10	[2] 2.00	2.13	.056	.76	.11	.015	.009
19	Jan. 12	.35	2.13	.112	.48	.09	.02	.005
20	Jan. 16	[1] .75	2.13	.28	.28	.015	.00	.010
21	Jan. 19	[1] .25	2.84	.04	.56	.100	.002	.026
22	Jan. 20	[2] 3.00	4.97	.056	.24	.200	.003	.005
23	Feb. 8	[2] 3.00	2.13	.32	.04	.110	.002	.007
24	Feb. 15	[1] .4	4.97	.112	.72	.10	.061	.12
25	Feb. 22	[2] 2.00	2.13	.28	.72	.120	.00	.015
26	Feb. 25	[2] 4.00	2.84	.28	.136	.05	.00	.014
27	Mar. 4	[1] .33	3.55	.20	.56	.085	.015	.00
28	Mar. 7	[1] 4.00	3.55	.36	.36	.05	.00	.024
29	Mar. 10	[1] .25	2.13	.04	.72	.05	.015	.0103
30	Mar. 16	[2] 2.00	3.55	.136	.112	.02	.004	.00
31	Mar. 24	[1] .25	4.26	.02	1.98	.2	.028	.14
32	Mar. 27	[2] 3.00	2.84	.16	.32	.0475	.0075	.007
33	Apr. 11	[1] 1.5	3.55	.20	.36	.05	.008	.009
34	Apr. 22	[1] .4	3.55	.96	.24	.09	.03	.015
35	May 1	[1] 1.1	3.55	.56	.20	.10	1.35	.00
36	May 3	[1] .9	2.13	.16	.056	.045	.009	.00
37	May 13	[1] .55	4.26	.40	.112	.05	.01	.009
38	May 19	[1] .45	5.68	.28	.112	.105	.017	.0086
39	May 28	[1] 2.75	3.55	.08	.04	.10	.005	.007
40	June 2	[1] 1.00	3.55	.112	.056	.10	.005	.00

[1] Rain. [2] Snow.

TABLE 2.—*Pounds per acre*

Specimen	Date, 1934–35	Depth of rain or snow	Chlorine	Free ammonia	Alf. ammonia	N in nitrate	N in nitrite	Sulphate, SO_3
		Inches						
1	June 23	[1] 0.2	0.096	0.0019	0.0144	0.036	0.00	0.00
2	June 25	[1] .4	.26	.0036	.0099	.0054	.00	.00
3	Sept. 28	[1] .12	.096	.02	.0075	.011	.0003	.00
4	Oct. 20	[1] 1.2	.97	.098	.065	.19	.005	.0044
5	Nov. 3	[1] 1.75	1.29	.06	.078	.04	.008	.00
6	Nov. 18	1.15	.37	.02	.008	.034	.00	.0034
7	Nov. 20	1.00	.50	.04	.026	.02	.005	.002
8	Nov. 22	.95	.31	.02	.043	.02	.007	.002
9	Nov. 22	[1] .08	.09	.006	.009	.042	-------	.002
10	Nov. 26	[1] .20	.095	.0018	.032	.0045	.0009	.0025
11	Nov. 28	[1] 1	1.61	.0045	.036	.044	.032	.0016
12	Nov. 30	[1] 1.5	.72	.0136	.068	.00	.001	.0031
13	Dec. 3	[2] 6.4	.13	.006	.018	.0045	.0005	.0005
14	Dec. 6	[2] 4	.11	.006	.043	.0009	-------	.0006
15	Dec. 19	[2] 2	.11	.009	.015	.0004	.0004	.0002
16	Dec. 26	[2] 2	.00	.0213	.0304	.0196	.0011	.0008
17	Jan. 9	[1] .4	.33	.012	.0655	.0045	.0011	.0009
18	Jan. 10	[2] 2	.082	.002	.029	.004	.0006	.0003
19	Jan. 12	[1] .35	.17	.009	.038	.0072	.0016	.0004
20	Jan. 16	[1] .75	.36	.048	.048	.0026	.00	.0017
21	Jan. 19	[1] .25	.162	.0023	.032	.0057	.00011	.0015
22	Jan. 20	[2] 3	.283	.003	.014	.0114	.00015	.0003
23	Feb. 8	[2] 3	.125	.019	.0024	.0065	.0014	.0004
24	Feb. 15	[1] .4	.45	.0102	.0655	.0090	.0055	.0011
25	Feb. 22	[1] 2	.081	.011	.027	.0045	.00	.0057
26	Feb. 25	[1] 4	.22	.021	.0106	.004	.00	.0011
27	Mar. 4	[1] .33	.27	.015	.043	.0064	.0011	.00
28	Mar. 7	[2] 4	.202	.021	.21	.0028	.00	.0018
29	Mar. 10	[1] .25	.121	.0022	.041	.003	.0009	.0006
30	Mar. 16	[2] 2	.135	.005	.0042	.0007	.0002	.00
31	Mar. 24	[1] .25	.243	.0409	.112	.0104	.0016	.008
32	Mar. 27	[1] .3	.162	.0091	.018	.0027	.0004	.0004
33	Apr. 11	[1] 1.5	1.207	.068	.1088	.017	.0027	.0031
34	Apr. 22	[1] .4	.390	.1005	.026	.01	.0033	.0017
35	May 1	[1] 1.1	.9	.14	.05	.025	.34	.00
36	May 3	[1] .9	.43	.032	.0112	.009	.0018	.00
37	May 13	[1] .55	.53	.05	.014	.0063	.0013	.001
38	May 19	[1] .45	.568	.028	.0112	.0105	.0017	.00086
39	May 28	[1] 2.75	1.86	.042	.02	.052	.0025	.00037
40	June 2	[1] 1	.816	.0257	.0124	.023	.00115	.00

[1] Rain. [2] Snow.

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